

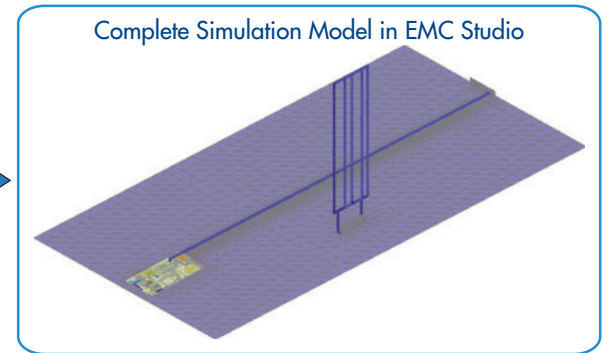
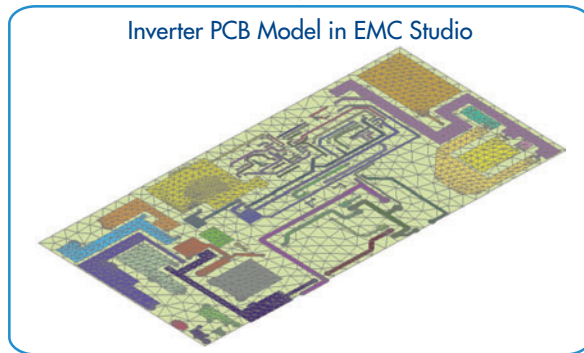
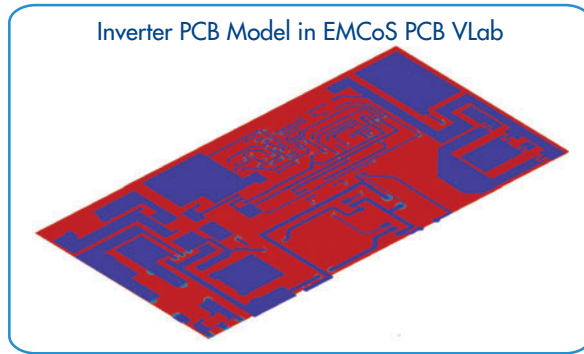


# INVERTER PCB MODELING

## Introduction

This document demonstrates modeling of Printed Circuit Boards (PCB) with Green Function approach using new powerful tools of EMCoS PCB VLab and EMC Studio. In conjunction, these two products make it easy to build a full simulation chain for various types of PCB models. This application note considers case of power Inverter PCB and its coupling to glass antenna. The obtained results are compared to laboratory measurements.

## Simulation Workflow



Simulation workflow consists of the following steps:

- Importing of Inverter PCB model from ODB++ file format in EMCoS PCB VLab
- Assignment of physical parameters using EMCoS PCB VLab tools
- Converting of computational model of Inverter PCB to EMC model
- Importing of Inverter PCB model to EMC Studio project
- Construction of complete simulation task for analysis in EMC Studio environment
- Calculation of coupling from Inverter PCB to glass antenna
- Comparison of numerical results with measurements

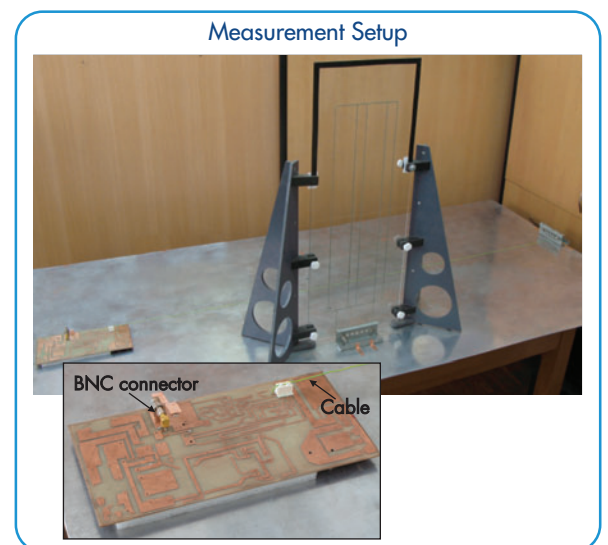
## Measurement Setup

Measurement setup contains single wire connected to Inverter PCB and glass antenna located at 28 cm from cable.

Parameters components of setup are listed in table below.

PCB Parameters		Wire Parameters		Antenna Parameters	
		Radius of wire	0.3 mm	Width of strip	2.0 mm
Thickness of substrate	2.0 mm	Insulation thickness	0.3 mm	Thickness of glass	3.0 mm
Dielectric losses	0.04	Dielectric losses	0	Dielectric losses	0
Permittivity of substrate	4.2	Permittivity of insulation	3.8	Permittivity of substrate	6.6

Measurements of coupling from Inverter PCB were performed in EMCoS laboratory.

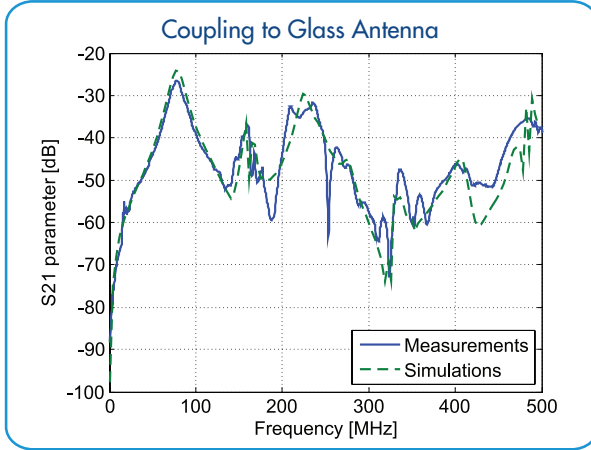




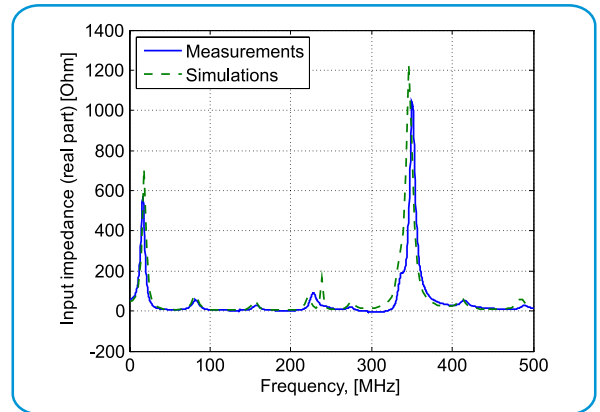
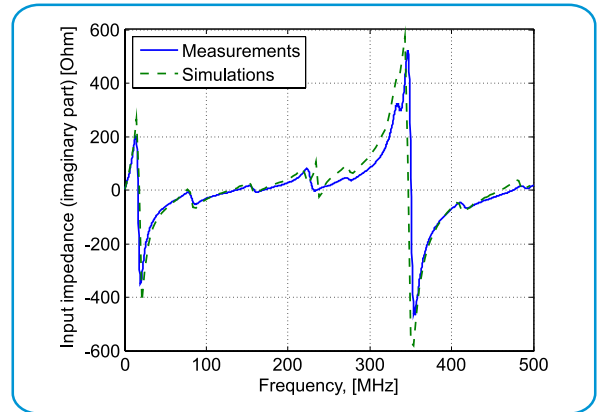
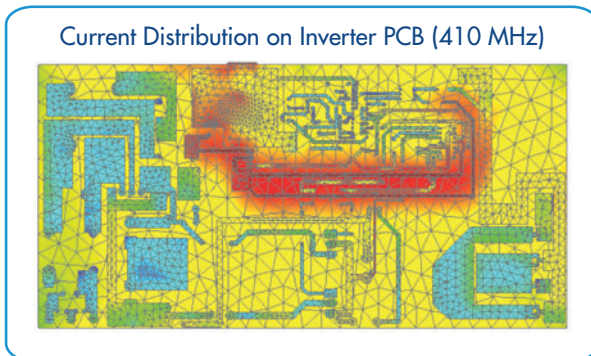
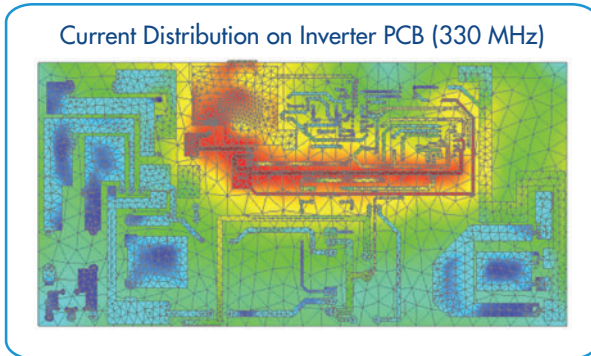
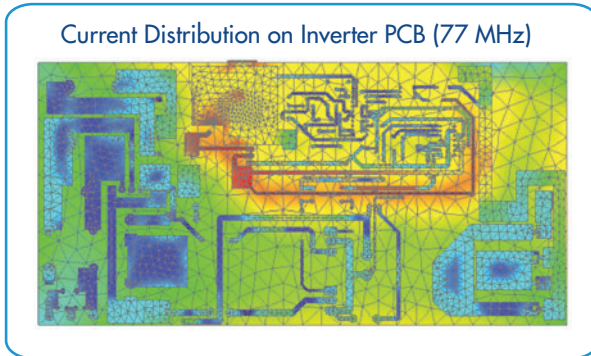
# INVERTER PCB MODELING

## Results

The comparison of simulation and measurement results is shown below. There is good agreement between measurement and simulation results in considered frequency range.



The current distribution on Inverter PCB for several frequencies is shown below.



## Calculation Efficiency

The calculation efforts required for investigations are listed below. Calculations were performed on EMCoS cluster and on standalone PC. Computational time for one model calculation of 143 sample points in complete frequency range from 300 kHz to 500 MHz is shown in table.

Type	Configuration	Single Frequency (RUN Time)	Full Frequency Range (RUN Time)
Cluster	20 Intel Xeon 5160 Dual Core 64-bit CPUs, Total speed ~120 GHz, 160 GB RAM	1.5 min	3.5 hours
Single PC	Intel Core i7 64-bit CPU, 2.8 GHz, 12 Gb RAM	22 min	52.5 hours

## Conclusions

According to performed investigation the main conclusions are:

- Computational model of PCB can be effectively generated using EMCoS PCB VLab and EMC Studio
- Simulation results of coupling from PCB are in good agreement with measurement results